



CSEP Progress and Plans

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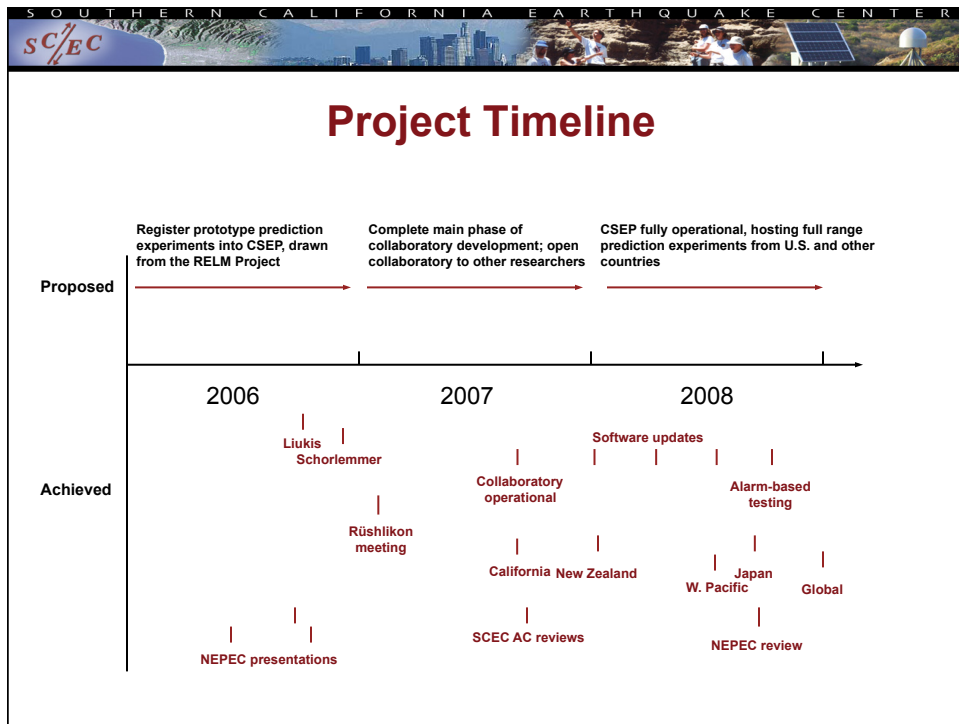
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Original CSEP Objectives

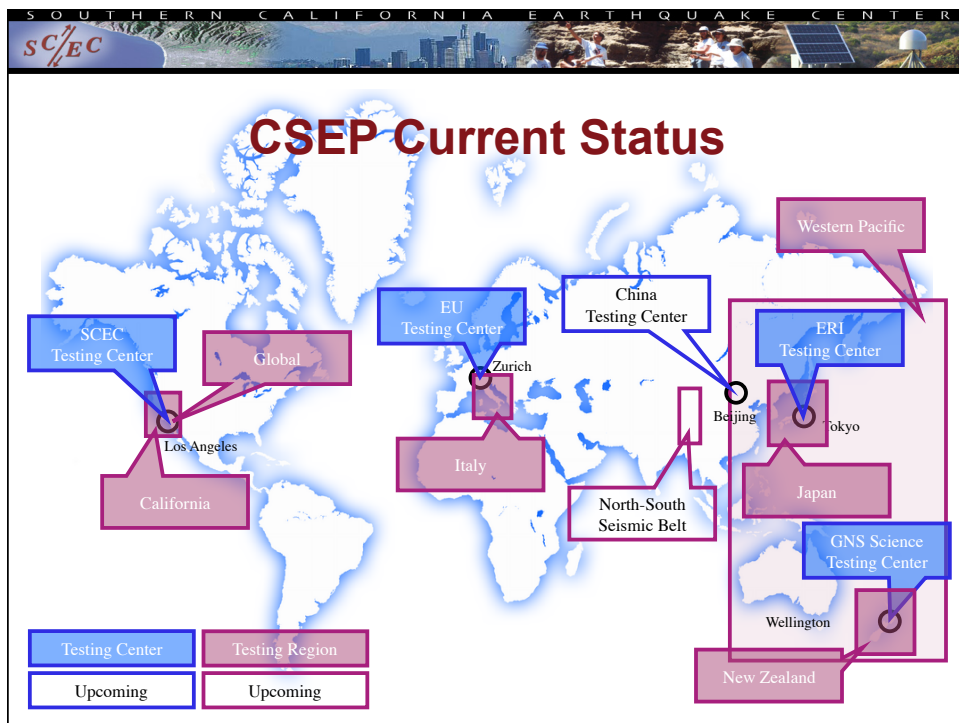
- 01.** Establish rigorous procedures for registering and evaluating prediction experiments
- 02.** Construct community standards and protocols for comparative testing of predictions
- 03.** Develop an infrastructure that allows groups of researchers to participate in prediction experiments
- 04.** Provide access to authorized data sets and monitoring products for calibrating and testing prediction algorithms
- 05.** Accommodate experiments involving fault systems in different geographic and tectonic environments



SOUTHERN CALIFORNIA EARTHQUAKE CENTER

CSEP Progress

- **Achieved 3-year project objectives**
 - Reviewed by W. M. Keck Foundation in Dec '08
- **Continued global expansion**
 - Italy
 - Japan
 - China
- **In 4th year of development, using residual funding**
 - Personnel: D. Schorlemmer, M. Liukis
 - Highly leverage within SCEC and internationally
- **Preparing USGS proposal**
 - NEPEC review completed in May, 2009
 - Developments now oriented toward facilitating NEPEC/CEPEC evaluations and operational earthquake forecasting





CSEP Development Objectives

- **Expand testing methods**
 - Alarm-based testing ✓
 - Scoring methods based on contingency tables
- **Test forecasts at larger magnitudes**
 - Expanded set of natural laboratories ✓
 - Global testing program ✓
 - Model classes for legacy methods; e.g., M8/MSc
 - Testing of fault-based models
- **Establish reference models to quantify skill**
 - Long-term time-independent models
 - Short-term ETES models
- **Testing of U.S. operational models**
 - STEP(✓), NSHMP, UCERF3



ICEF Findings & Recommendations

- **Verification of Earthquake Forecasting Methods**
 - Forecasting models considered for operational purposes should demonstrate reliability and skill with respect to established reference forecasts, such as long-term, time-independent models.
 - *Recommendation F1: Forecasting methods intended for operational use should be scientifically tested against the available data for reliability and skill, both retrospectively and prospectively. All operational models should be under continuous prospective testing.*
 - *Recommendation F2: The international infrastructure being developed to test earthquake forecasting methods prospectively should be used as a tool for verifying the forecasting models for Italy.*



Operational Earthquake Forecasting

- Criteria for the “operational fitness” of earthquake forecasts:
 - **Consistency**: correspondence of forecasts in one range of spatiotemporal scales with those in another
 - **Quality**: correspondence of forecasts with observations
 - **Value**: incremental benefit of forecasts to users
- CSEP’s primary role is to evaluate forecast quality
 - There are many aspects of forecast quality
 - Absolute verification: accuracy, reliability, resolution, sharpness, discrimination
 - Relative verification: skill (of various types)
- CSEP reference models will also promote consistency
 - Unification across temporal and spatial scales (e.g. UCERF3)



CSEP Development Objectives

- Support for UCERF3 development
 - Build testability into UCERF3 (retrospective and prospective)
 - Establish UCERF3 as California reference model
- Test scientific hypothesis that underlie forecasting methods
 - Maximum magnitude based on fault geometry
 - Characteristic earthquakes; rupture arrest by identified segment boundaries
 - Modulation of earthquake rates by Coulomb stress
 - Ability of rupture to jump fault gaps
 - Stress renewal



CSEP Development Objectives

- **Expand prospective testing to models based on non-seismic data**
 - Continue to accept time-independent models ✓
 - Black-box testing of time-dependent models, including predictions based on diagnostic precursors
 - Develop authoritative data streams for time-dependent models (e.g. geodesy, tidal loading)
- **Expand retrospective testing over the entire history of instrumental catalogs**
 - Characterize catalog non-stationarity
- **Test in real-time**
 - Reduce testing latency by modeling catalog completeness and accuracy as a function of time



CSEP Development Objectives

- **Develop tools to help NEPEC and CEPEC deal with seismic crises and emergent situations**
 - “Evaluate now” function for immediate evaluation of forecast probabilities during crisis
 - Rapid-response Content Management System for posting results and sharing information
- **Expand to include the testing of ground-motion predictions**
 - Retrospective and prospective testing
 - NGA and CyberShake predictions
- **Support other prospective testing activities**
 - Earthquake early warning
 - Geodetic transient detection

